the patient is lying on his or her side, and small volumes of local anesthetic solution are slowly injected, gravity causes the solution to be deposited along the lowermost part of the epidural space and also favors escape of the solution toward the dependent paravertebral area.[1] 2) Acquired[2] or congenital[3] midline adhesions between the dura mater and the lamina may act as diffusion barriers, regardless of the patient's position. 3) If an excessive length of catheter is introduced epidurally,[4] the catheter tip may pass into the paravertebral area and subsequent unilateral anesthesia may occur. 4) The catheter tip may be placed in the anterior epidural area, thereby favoring longitudinal and ipsilateral transverse spread of anesthetic rather than circumferential spread around the dura.[5]

In this patient, an epidural catheter was not used and the unblocked side was the dependent side, thus eliminating causes 1, 3, and 4. This leaves a strong possibility of either an acquired or congenital abnormality as the probable cause of unilateral analgesia. However, in this patient, *both* epidural and subarachnoid blocks produced unilateral analgesia. There has been no case report of unintentional unilateral spinal blocks, even though patchy or inadequate blocks have been caused by low drug dosage, time-expired drugs, improper positioning, and failure to deposit a part of the anesthetic intrathecally.

The following is offered as a possible explanation for the unilateral analgesia in this patient. The pia mater is a thin vascular membrane that closely invests the spinal cord and extends four ligamentous projections to the dura (fig. 1). It is conceivable that if these ligaments were overdeveloped and unbroken, they could interfere with the subarachnoid spread of local anesthetic agents and result in unilateral subarachnoid block.[6]

As mentioned, this patient had scoliosis of the lumbar spine. Valentino[7] has demonstrated with myelography a unilateral distribution of contrast medium in some patients with severe scoliosis. He hypothesized that the dura on the convex aspect of the spine is tensed like the chord of an arc, causing the spinal cord to be pressed against the opposite surface of the spinal canal and the subarachnoid space to be squeezed between the spinal canal wall and the cord. This condition could also hinder the movement of cerebrospinal fluid and local anesthetics placed in the subarachnoid space.

Summary

A case of unintentional unilateral analgesia following both epidural and subarachnoid block is presented. It is suggested that the presence of an anomalous congenital midline diffusion barrier in both the epidural and subarachnoid spaces could explain this phenomenon.

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Experiences with a New Endotracheal Tube for Microlaryngeal Surgery

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The introduction of the operating microscope[1–3] made earlier[4] anesthetic techniques inadequate for microlaryngeal surgery.

In developing new methods, Urban[5] and Oulton[6] turned to the venturi principle for their techniques of nonintubated ventilation. Carden[7] and Spoerel[8]

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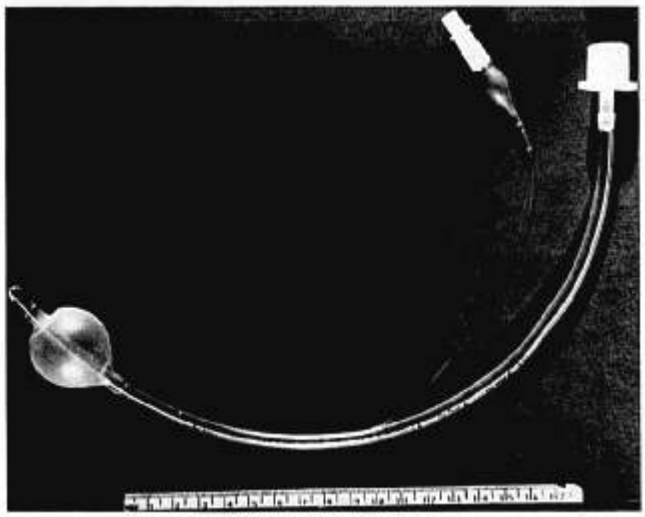

FIG. 1. Four-millimeter-I.D. cuffed endotracheal tube.

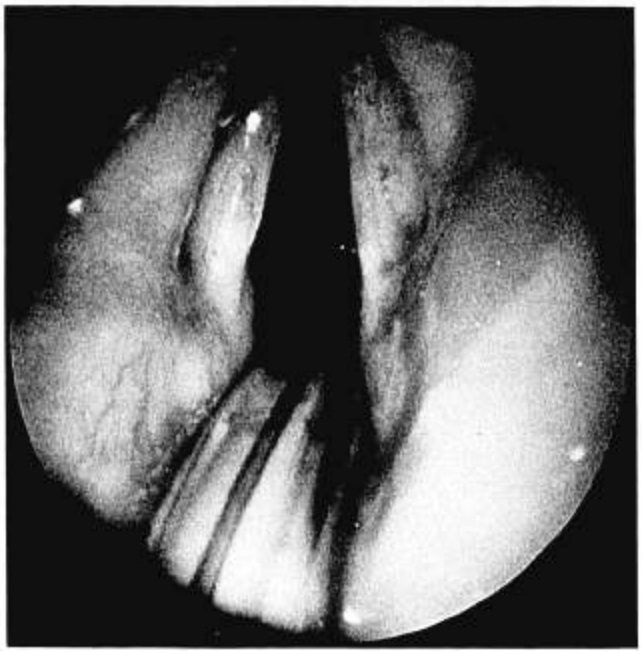

FIG. 2. Endotracheal tube in the larynx of an adult female patient.

relied on small endotracheal tubes, high flows and high gas pressures. These methods afforded good operative conditions and ventilation, but each method had drawbacks. Nonintubated ventilation had the risk of blowing surgical debris intratracheally.[6] Spoerel reported dangers of tissue emphysema and pneumothorax caused by misplacement of ventilation catheter. El-Naggar[9] has reported difficulty encountered placing a Carden tube. All these methods required special materials and equipment and were limited to nitrous oxide anesthesia with intravenous supplements.

Manufacturers‡ of the standard 4-mm-I.D. endotracheal tube were asked to produce a longer 4-mm I.D. tube with a larger cuff. This tube was to be used in a teenaged boy who had needed anesthesia repeatedly for removal of recurrent laryngeal papillomas since the age of 4 years, and who had outgrown the standard 4-mm tube. It became evident that, if properly managed, an adult patient could be safely anesthetized and adequately ventilated in the same way, and that very good exposure of the surgical field could be obtained.

Our experience with a cuffed 4-mm-I.D. endotracheal tube in the delivery of inhalational and N_2O–O_2–narcotic anesthesia for microlaryngeal surgery is reported.

MATERIALS AND METHODS

The tube used had an internal diameter (I.D.) of 4 mm; the length was shortened to meet the individual patient's needs. The tube had a standard 15-mm connector. The 1⅜-inch-long cuff inflated to the size of an adult-sized, standard endotracheal tube cuff (fig. 1). When laser surgery was to be used, the tube was covered with aluminum foil tape.

The tube was used in procedures in which visualization and manipulation of the vocal cords and surrounding structures were necessary, *e.g.*, microlaryngoscopic vocal cord biopsy, stripping, Teflon® injection, and laser surgery.

Thirty patients were studied. Their physical status, ages and weights are summarized in table 1. Forty per cent of these patients had histories of smoking and notable pulmonary disease.

The patients were premedicated according to the judgment of the physician administering the anes-

‡ National Catheter Company, A Division of Mallinckrodt, Inc., Argyle, New York.

TABLE 1. Patient Data

	Mean ± SD	Range
Age (years)	43 ± 18	12–84
Weight (kg)	70 ± 18	37–103
ASA physical status	—	I–III

TABLE 2. Blood-gas Data Summary

	Mean ± SD	Range
Pa_{CO_2} (torr)	38 ± 5	27–51
*p*H	7.38 ± .05	7.28–7.52
Pa_{O_2} (torr)	176 ± 107	73–479

thesia. Intravenous infusions were started, and appropriate monitors were placed. An Allen test to determine adequate radial and ulnar blood supply was performed on each patient. After an intravenous thiopental induction, adequate inhalational anesthesia was obtained with high flows of N_2O–O_2 and either enflurane or halothane with mask and standard circle-absorber system. When blood pressure dropped to 80 per cent of preinduction levels, succinylcholine was given intravenously and the trachea intubated. When necessary, a stylette was placed inside the tube to permit better maneuverability. The experiences of the laryngoscopist varied from a few weeks of training to that of a staff physician. After tracheal intubation, anesthesia was maintained with lower flows of N_2O–O_2 and either enflurane or halothane. Intraoperative relaxation was continued with 0.1 or 0.2 per cent succinylcholine drip. Manual ventilation was performed with pressures between 20 and 30 cm H_2O measured at the inspiratory limb of the circle. In three patients, a short-acting narcotic was used instead of the potent inhalational agents.

The chest was observed for complete exhalation before starting the next inspiratory cycle. Failure to wait for complete exhalation could cause dangerous overinflation of the lungs[10] and impairment of venous return to the heart.

At the conclusion of the procedure, the relaxant was discontinued and arterial blood gases were drawn. The trachea was extubated when spontaneous breathing was adequate.

Results

There were no difficulties in intubating the tracheas of any of the patients. The procedures lasted 15–70 min. Summarized results and arterial blood-gas determinations and inspired O_2 concentrations are shown in table 2.

The Pa_{CO_2} values indicate that ventilation was adequate, and the Pa_{O_2} values show oxygenation was within physiologic ranges in all patients. The marked variations in Pa_{O_2} are a reflection of the wide range of FI_{O_2}s (0.3–1.0) delivered to the patients.

The procedure had to be discontinued in one operation because hypotension developed. The trachea was immediately extubated, and the patient was ventilated by mask until his blood pressure returned to preintubation levels. His trachea was then reintubated with a larger (5.5-mm-I.D.) endotracheal tube. The hypotension was probably the result of high intrathoracic pressure. There was no other intra- or postanesthetic complication in this or any other patient.

The surgeons rated the operative field as very good to excellent. The size of the tube cuff did not interfere with their operative procedure (fig. 2).

Discussion

The advantages of this technique are: 1) the endotracheal tube is easily placed; 2) no special equipment is necessary; 3) the adult-sized cuff prevents aspiration of blood and surgical debris; 4) the tube provides very good exposure of the surgical field; 5) any anesthetic technique can be used.

The occurrence of hypotension in one of the patients reinforces the need for close monitoring of the vital signs and observing the movement of the chest so as to avoid gas entrapment.

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